REMARKS

Claims 1 and 3-19 are all the claims pending in the application. Reconsideration and allowance of all the claims are respectfully requested in view of the following remarks.

Drawings

The Examiner approved the proposed drawing corrections as filed on June 24, 2002. Accordingly, filed herewith are drawings that incorporate the proposed changes.

Claim Rejections - 35 USC § 112

The Examiner rejected claims 18 and 19 under § 112, 1st paragraph, as containing subject matter which was not described in the specification. The Examiner asserts that the subject matter in claim 18 is new matter. Applicants respectfully traverse this rejection because the specification does, indeed, provide an adequate written description of the invention as set forth in claim 18. Support can be found, for example, in the following passages from the specification.

On page 1, lines 4-8, the specification sets forth that the present invention relates to a machined retainer of a rolling bearing. The machined retainer of the rolling bearing is made by machining/grinding forged products, bar materials or cast ones, and ordinarily it is formed with Cu alloys.

On page 2, lines 1-5, the specification sets forth that YBsC3 is a free-cutting brass material wherein Pb is added to the brass.

Additionally, on page 3, lines 14-18, the specification sets forth that an object of the invention is to provide a machined retainer of a rolling bearing made of a material wherein crystals of intermetallic compound are finely dispersed in a base material comprising a Cu alloy.

Further, on page 5, line 24 - page 6, line 15, the specification sets forth that "the instant alloy can be produced by excluding lead (Pb) from such as YBsC3 and casting a material ..." That is, YBsC3 is a well known free-cutting brass that typically contains Pb in the range of from 0.5 to 3.0 %. See, for example, the Japanese Industrial Standards (JIS) H 5101 that relates to "Brass Casting", a copy of which is attached hereto for the Examiner's convenience. And "excluding lead" from such a brass is the same as "reducing an amount" of lead in the brass.

In light of the above description, it is clear that the specification does provide support for the method steps as now set forth in claim 18. Applicants note, however, that claim 18 has been amended to correct a typographical error in the amount of lead in YBsC3 brass. As shown in the attached JIS H 5101 relating to "Brass Casting", YBsC3 type brass includes 0.5 to 3.0% Pb.

The Examiner rejected claims 18 and 19 under § 112, 2nd paragraph, as indefinite. Specifically, the Examiner asserts that "the intermetallic compound" lacks antecedent basis. Accordingly, Applicants have amended claim 18 so as to read --intermetallic compounds--.

Claim Rejections - 35 USC § 103

The Examiner rejected claims 1-19 under § 103(a) as being unpatentable over the alleged prior art as set forth on page 1, lines 6-16 of the present specification (hereinafter the APA) in view of JP 61-133,357 (hereinafter JP '357) and further in view of JP 60-174,842 (hereinafter JP '842). Applicants respectfully traverse this rejection for the following three reasons.

First, Applicants arguments as set forth in the Amendment filed on June 24, 2002 are still pertinent and, therefore, are incorporated herein by reference.

Second, Applicants have prepared the following supplemental test data to show a criticality/superiority of the invention as set forth in the claims.

Supplemental Data

Exhibit A, attached hereto, shows supplemental data of the critical importance, with respect to the retainer of the present invention, of containing no Pb, or including it in an amount of 0.4% or less.

To make clear the individual influence of Pb on surface coarseness, in Exhibit A various test samples are shown wherein the amount of Pb is changed from 0 to 1.4% by weight while not changing the basic alloy compositions of two types of alloys each having different basic compositions (composition systems A and B).

The listed alloys are all subjected to a machining test under the following conditions for comparison of surface coarseness.

Diameter of Test Piece : 40mm

Cutting Speed : 100m/min

Feed Speed : 0.11mm/rev

The result shows, for both composition systems A and B, that greater than 0.4% Pb makes the surface more coarse, and 0.4% Pb or lower makes the surface less coarse. Also, see Exhibit B, wherein surface coarseness is shown for various ones of the samples from Exhibit A.

This is probably because, although 0.5% Pb or higher reduces machining resistance, shearing occurs discontinuously to cut grain, resulting in a coarse surface.[1]

In view of such results, 0.4% Pb or lower, preferably no Pb, successfully makes the surface less coarse to a greater degree.

Difference between Present Invention and Cited References

The invention disclosed in the cited Japanese references are sliding bearings, while the present invention is related to a retainer of rolling bearing. This difference in bearing types leads to a very significant structural difference between the present invention and that in the cited references.

The sliding bearing in the cited references directly receives a load. On the other hand, unlike the cited references, the retainer of rolling bearing of the present invention does not directly receive a load but merely receives stress from a rolling body at the time of rotation. This is evident from the different hardness between the cited reference (often exceeding Hv200) and the present invention not exceeding Hv200. See, for example, Fig. 6, wherein it is shown that the Hardness of the present invention is generally not exceeding Hv200.

As such, the present invention has different object and application from the cited reference. Further, unexpected effects are achieved with no Pb, or with a lead content of 0.4% or lower. Such effects are not taught or suggested in the cited references.

Third, with respect to claim 18, Applicants have the following additional comments.

Conventionally, for machined retainers, the high strength brass cast-Category 1 (HBsC1) by JIS or the high strength brass cast-Category 2 (HBsC2), were used.

[1] Although Applicants provide one possible explanation for their discovered phenomenon, they do not wish to be bound by the theory set forth herein.

As the conditions during use of rolling bearings have recently become severe, it has also been demanded that retainers of the rolling bearings possess high processing precision. Especially, if a column of the retainer is tilted, the column and the rolling body interfere with each other and issue creaking, so that sound effect is deteriorated. Therefore, in recent times, a free-cutting brass having higher machinability than the high strength brass, has been used as the Cu alloy for the machined retainer.

As shown in JIS H5101, relating to "Brass Casting", the free-cutting brass typically contains Pb in the range of 0.5 to 3.0 %. In the free-cutting brass material, a high cutting property can be provided in that Pb grains scattered in a base material serve as a chip breaker reducing a cutting stress.

However, since the free-cutting brass is weak in a binding strength between the base material and the Pb grains, the Pb grains easily fall out during machining, and traces of these fallen-off grains easily remain in the surface of the retainer after grinding. As a result, there is a risk that coarseness grows larger in the retainer surface and lowers the sound effect.

If the coarseness in the retainer surface is large, amounts of initial abrasion in a pocket face and a guiding face may be large. In such a case, dimensions of the retainer are changed during working, otherwise abrasion powders are mixed as foreigners in a lubricant, and delamination will start from the surface of a bearing ring or a rolling body.

Further, because the Pb grain is very soft, yield stress of the free-cutting brass is low, and plastic deformation easily occurs if excessive stress is loaded during the cutting process. Therefore, if the machined retainer is formed with the free-cutting brass, as in the art cited by the Examiner, the columns of the retainer are plastic-deformed and the sound effect may be deteriorated.

The rolling elements of the bearing are rotatably held between adjacent columns of the retainer and between the inner and outer rings.

In addition, Pb is a harmful substance to human living bodies and environments. Accordingly, addition of much Pb to brass for increasing the machinability is not desirable. Besides, the retainer made with Cu alloy containing much Pb has a room to be improved in the abrasion resistance.

The present invention has been established by paying attention to the above-noted problems involved with the prior art.

The machined retainer of the rolling bearing according to the present invention was formed in accordance with the steps in claim 18: lead (Pb) is reduced to less than 0.4 wt% from the base material comprising a free-cutting brass such as YBsC3 that contains Pb in the range of 0.5 to 3.0 wt%. Such material is subjected to casting while adding any two or more components selected from Si, Mn, Fe, Nb, Ti, and Co. Such material is cooled in such a manner that intermetallic compounds including the added components are crystallized and dispersed into the base material.

Accordingly, it is possible for the present invention to form the machined retainer with such a material having high machinability, mechanical strength, sound effect, and abrasion resistance, and also having no problem in regards to safety and the protection of the environment.

The alloy of the presently claimed invention has the high machinability because the crystals of the intermetallic compound scattered in the base material serve as chip breakers reducing the cutting stress. Since the crystals are finely scattered, cut dusts when cutting become smaller and, at the same time, the binding strength between grains of the crystal and the base material become high. As a result, Pb grains are difficult to fall off, and the fallen-off traces are less likely to remain in the retainer surface after grinding. Accordingly, the coarseness of the retainer surface is satisfactory.

Since the intermetallic compound (especially Mn5Si3) is very much harder (around Hv700) than the α phase and β phase of the base material, and because the harder crystals are finely scattered in the base material, the grains of the intermetallic compound act as strengthening grains of the base material. The yield stress is high thereby in comparison with those of the free-cutting brass or the high strength brass, and if an excessive stress is loaded during machining, the plastic deformation is less likely to occur.

Thus, depending on this alloy, it is possible to obtain a desired strength with a smaller thickness than that of the existing machined retainer. Since the weight of the machined retainer

can be thereby made lighter than that of the existing one, the machined retainer formed with this alloy can be used at high speed rotation which has conventionally not been applicable.

Also, in this alloy of the presently claimed invention, the mechanical strength is high, so that the width of the column can be narrower than that of the existing machined retainer. Thus it is possible to make a load capacity large by making the diameter of the rolling body large or by making the diameter of the rolling body large to by increasing the number of rolling bodies.

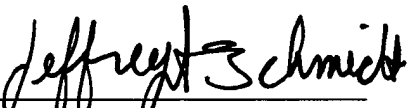
For at least any of the above reasons, claims 1 and 18 are not rendered obvious by the APA, JP '357 and '842. Likewise, dependent claims 2-17 and 19 are not rendered obvious by these references.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



Jeffrey A. Schmidt
Registration No. 41,574

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

23373
PATENT TRADEMARK OFFICE

Date: March 10, 2003

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims have been amended as follows:

18. (Amended) A machined retainer, of a rolling bearing, said retainer being formed by a producing method comprising:

reducing Pb from a base material comprising a free-cutting brass that contains Pb in the range of 0.5- 3.0 ~~2.0~~ wt%, wherein the amount of Pb is reduced to an amount in the range of from greater than 0 wt% to 0.4 wt% or lower,

casting the base material, from which the Pb has been reduced, while adding any two or more components selected from the group consisting of Si, Mn, Fe, Nb, Ti, and Co,

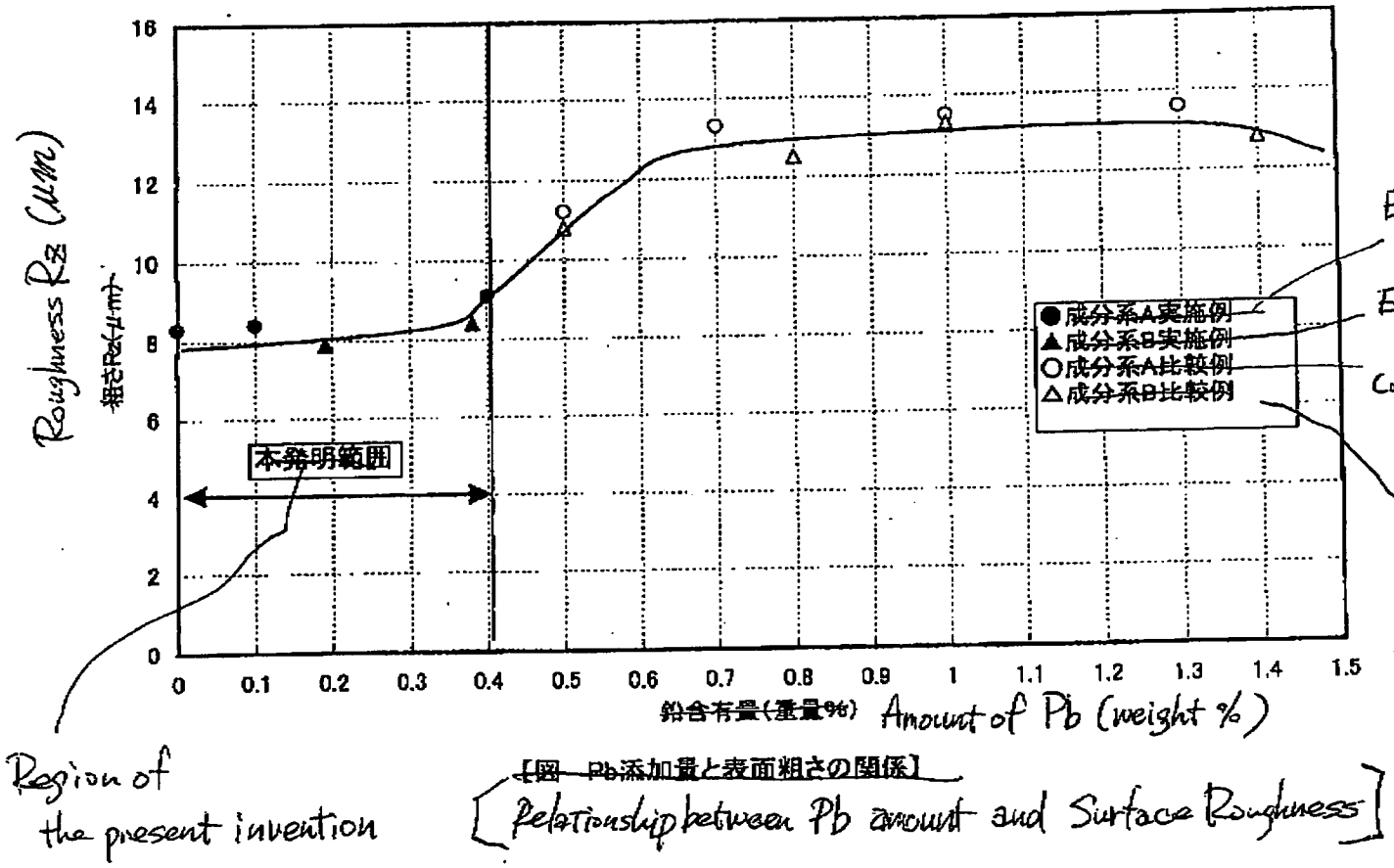
cooling, after the casting, in such a manner that ~~the~~ intermetallic ~~compound~~ compounds including the added components ~~is~~ are crystallized, and scattered into the base material.

TEST DATA

	No.	Cu	Si	Pb	Sn	Fe	Mn	Ni	Al	Zn
	Component System A-1	76.0	2.9	-	-	-	-	-	-	Remainder
Example	Component System A-2	75.9	2.9	0.1	-	-	-	-	-	Remainder
	Component System A-3	75.8	2.9	0.4	-	-	-	-	-	Remainder
	Component System A-4	76.2	2.8	0.5	-	-	-	-	-	Remainder
Comparison Example	Component System A-5	76.3	2.9	0.7	-	-	-	-	-	Remainder
	Component System A-6	75.9	3.0	1	-	-	-	-	-	Remainder
	Component System A-7	75.9	2.8	1.3	-	-	-	-	-	Remainder
Example	Component System B-1	59.9	-	0.2	0.2	0.7	2.2	0.2	0.7	Remainder
	Component System B-2	59.6	-	0.4	0.2	0.7	2.4	0.2	0.6	Remainder
	Component System B-3	60.1	-	0.5	0.2	0.7	2.3	0.1	0.6	Remainder
Comparison Example	Component System B-4	60.0	-	0.8	0.2	0.7	2.2	0.2	0.7	Remainder
	Component System B-5	59.9	-	1.0	0.2	0.7	2.2	0.2	0.7	Remainder

EXHIBIT A

-03- 3- 5; 5:04PM;NGB SUGHRUE(1) ;8135613954 # 4/ 6



【図 Pb添加量と表面粗さの関係】

[Relationship between Pb amount and Surface Roughness]

EXHIBIT B

.03- 3- 5; 5:04PM;NGB SUGHRUE(1) ;8135613954 # 6/ 6

JIS H 5101 (1982) JIS5101

黄銅鋳物 (棒状)

Brass Castings

JIS (1954, 58, 56, 76, 79) 改正
JES 合併 0621
旧 JES 136

1. 適用範囲 この規格は、一般用途黄銅鋳物（以下、鋳物という。）について規定する。

2. 種類及び記号 鋳物の種類及び記号は、化学成分によって、表1のとおり区分する。

YBsC1 YBsC2

表1 種類及び記号

種類	記号	参考
		特色及び用途例
1種	YBsC1	ろう付けしやすい。フランジ類、電気器具、装飾用品など。
2種	YBsC2	比較的強度が高くである。電気器具、計器部品、一般機械部品など。
3種	YBsC3	2種よりも機械的性質がよい。給排水金具、電気部品、自動車金具、一般機械部品など。

Brass Cast
Category 1
Category 2
Category 3
YBsC3

3. 品質

3.1 外観 鋳物は、鋳はだ良好で、使用上有害なきず、割れ、鋳巣などの欠陥があってはならない。

3.2 化学成分 鋳物の化学成分は、表2による。

less than 0.3

表2 化学成分 単位 %

種類	Cu	Zn	Pb	Sn	Al	Fe	Ni
1種	83.0～88.0	11.0～17.0	0.3以下	(0.1以下)	(0.2以下)	(0.2以下)	(0.2以下)
2種	65.0～70.0	24.0～34.0	0.5～3.0	(1.0以下)	(0.5以下)	(0.2以下)	(1.0以下)
3種	59.0～64.0	30.0～41.0	0.5～3.0	(1.0以下)	(0.5以下)	(0.8以下)	(1.0以下)

Category 1
Category 2
Category 3

備考 括弧を（ ）で示した成分は、注文者の要求があったものについてだけ分析を行う。

Pb 0.5～3.0%

3.3 機械的性質 鋳物の機械的性質（引張強さ・伸び）は、表3による。

表3 機械的性質

（平成3年1月1日から適用）

種類	引張試験	
	引張強さ N/mm²	伸び %
1種	245以上	25以上
2種	175以上	20以上
3種	245以上	20以上

4. 形状、寸法及び質量 鋳物の形状、寸法及び質量は、図又は図面による。形状、寸法及び質量の許容差は、受渡当事者間の協定による。

5. 試験

5.1 分析試験 化学成分の分析試験は、次のいずれかによる。

JIS H 1051（銅及び銅合金中の銅定量方法）
JIS H 1052（鉛及び銅合金中の鉛定量方法）
JIS H 1053（錫及び銅合金中の錫定量方法）
JIS H 1054（亜鉛及び銅合金中の亜鉛定量方法）
JIS H 1056（銅及び銅合金中のニッケル定量方法）
JIS H 1057（銅及び銅合金中のアルミニウム定量方法）
JIS H 1222（銅及び銅合金分析方法）

なお、発光分光分析方法、原子吸光光度分析方法又は蛍光X線分析方法については、受渡当事者間の協定による。

6.

5.2 引張試験 引張試験は、JIS Z 2241（金属材料引張試験方法）による。この場合の試験片は、4.(2)の供